FEDERAL TELECOMMUNICATIONS SYSTEM
FTS 2000 PROJECT

MILESTONE 4 FINAL REPORT

Contract No. GS-00K-8403-C0015
Task Order No. N4E478010
CRC Project No. 8474.04.80

Prepared for:

General Services Administration
Office of Info. Resources Management
7th and D Streets, SW
Washington, DC 20407

Prepared by:
CRC Systems, Inc.
11242 Waples Mill Road
Fairfax, Virginia 22030
703/359-9400

March 16, 1988

GSA

CRC
The Systems Specialists

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CRC Systems Incorporated
11242 Waples Mill Road, Fairfax, Virginia 22030
(703) 359-9400

March 11, 1988

Mr. Gene Daniels
Project Manager, Technical Support Group
General Services Administration (GSA)
Technical Services Division (WKT)
7th and D Streets, S.W., Room 1021
Washington, D.C. 20407

Re: Contract No. GS-00K-8403-C0015
Task Order No. N4E478010 (GSA)
CRC Project No. 8474.04.80

Dear Mr. Daniels:

The General Services Administration tasked CRC Systems, Inc. under Milestone 4 of this project to perform six additional iterations of the FTS2000 network beyond the initial 60-40 percent network split. The project commenced on January 11, 1988 and concluded on March 9, 1988.

A final briefing was presented to Messrs. Bill Parsons and Walter Ervine of GSA on March 10, 1988.

Enclosed is the final report for Milestone 4 which presents the results of the additional network splits of 15-85 percent, 20-80 percent, 25-75 percent, 30-70 percent, 35-65 percent, and 50-50 percent.

Please call me, or Mr. Charles Viator, if there are any questions.

Sincerely,

Charles J. Riviere
Program Manager

CJR:cwc
Enclosure

FEDERAL TELECOMMUNICATIONS SYSTEM

FTS 2000 ALTERNATIVE DESIGN PROJECT

FINAL REPORT

MILESTONE 4

SUBMITTED TO

MR. CARL PATRICK
VICE PRESIDENT

CRC SYSTEMS INCORPORATED

15 MARCH, 1988

SUBMITTED BY

SRA CORPORATION
2000 15TH STREET NORTH
ARLINGTON, VIRGINIA 22201

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EXECUTIVE SUMMARY

This report presents the results of Milestone 4 of the FTS 2000 Project. On January 11, 1988 GSA exercised their option to proceed with Milestone 4, which requested the CRC/SRA Team to examine six additional network splits beyond the initial 60 percent - 40 percent split. The network splits agreed to by GSA and the team are as follows:

	A	B		A	B
Iteration I	15%	85%	Iteration IV	30%	70%
Iteration II	20%	80%	Iteration V	35%	65%
Iteration III	25%	75%	Iteration VI	50%	50%

These scenarios followed the same criteria contained in the original study. Each network would have a nationwide footprint. Each Agency would be entirely served by one network and internetwork traffic would be kept to a minimum. The exception to this is the percent network split which is forced.

The Interagency Traffic Matrix developed for the original study was used to create the splits for the six iterations. Standard and aggressive pricing was used in evaluating the six designs.

The results of the work present three perspectives of the economic impact:

- o One as viewed from GSA, as the procurer who must consider total cost to the Government as the primary focus. All six iterations are relatively equal in terms of total network cost which is constant within 1.5% for any split. There is no abrupt fall-off in economy of scale below 40%. Refer to the graph entitled "FTS 2000 Network Designs - Unit Cost vs. split in Appendix A for a depiction of these findings across the seven design iterations.

- o The second from the standpoint of the user Agency, is that the cost for both networks should be nearly equal to avoid penalizing the users on the more expensive network which could lead to considerable shifting of Agencies between networks. For Agencies, the cost differential increases between the two networks as the split diverges from 60%-40% which has a cost differential of only .1 cents per minute between the two networks. Reference to the graph labeled "FTS 2000 Network Designs - Unit Cost by Network Split %" shows this divergence across all iterations.

- o The final perspective indicates that the vendors, under strong competition should bid cost per minute prices which do not exceed the results indicated in this study for the same service.

SECTION 1

INTRODUCTION

On January 11, 1988 GSA exercised their option to proceed with Milestone 4 of the FTS 2000 Project. This task required the examination of six additional network splits of the FTS 2000 single network. The following splits were selected to determine the economic and operational impact of re-splitting the A & B Networks:

Iteration I	15% - 85%	Iteration IV	30% - 70%
Iteration II	20% - 80%	Iteration V	35% - 65%
Iteration III	25% - 75%	Iteration VI	50% - 50%

The criteria established in the original Project was employed for this task. Both networks would have nationwide footprints. Each Agency would be wholly served by one network and internetwork traffic would be minimal. The only difference was the forcing of split boundaries. The primary focus would be on the sixteen largest Agencies, with care given that no Agency be omitted from either network. Iterations I through V would use Network "A" as the object for reduction, while Iteration VI would consider Network "B" as the object for reduction.

The methodology used in these studies is presented in Section 2. The details associated with each step are covered in Sections 2.1 through 2.6. Assumptions and constraints are discussed in Section 3. The findings of the team, cost comparison summaries and graphic representations for each iteration can be found in Section 4.

SECTION 2

METHODOLOGY

GSA tasked CRC/SRA, under Milestone 4, to determine the operational and economic impact of six additional splits of the FTS 2000 Network. The analysis would be performed using the following criteria:

- o - Percentage splits of 15-85, 20-80, 25-75, 30-70 and 35-65 were considered, with Network "A" being the object for reduction.
- o - One split of 50-50 was considered, with Network "B" being the object for reduction.
- o - Internetwork traffic would be minimized.
- o - The focus was on the sixteen largest Agencies, with all Agencies to be included and no single Agency would appear on both networks.
- o - Standard tariff and aggressive discount tariff pricing was used throughout.

The Team used the Interagency Traffic Matrix (developed to create the original FTS 2000 A and B Network splits) to create the six additional design iterations.

As a reference, the results of the initial 60-40 split were as follows:

Cost of Network "A" under standard pricing - 19.1 cents/min.

Cost of Network "B" under standard pricing - 19.0 cents/min.

Cost of Network "A" under aggressive pricing - 15.8 cents/min.

Cost of Network "B" under aggressive pricing - 15.3 cents/min.

2.1 Iteration I - 15/85 Network Split

2.1.1 Agency Partition

This configuration places only the Departments of Treasury and Justice on the "A" Network. Since these two Agencies are large, their traffic alone met the 15% requirement for the smaller network. The "B" Network, therefore, consists of all other Agencies, both large and small and represents 85% of the total traffic.

2.1.2 Results - Iteration I (15-85 split)

Cost of Network "A" under standard pricing - 23.4 cents/min.

Cost of Network "B" under standard pricing - 17.9 cents/min.

Cost of Network "A" under aggressive pricing - 19.0 cents/min.

Cost of Network "B" under aggressive pricing - 14.5 cents/min.

The "A" and "B" Networks have 408 and 1129 Service Delivery Points (SDP's) respectfully while 270 SDP's are dual homed.

2.2 Iteration II - 20/80 Network Split

2.2.1 Agency Partition

This configuration places the Departments of Treasury, Labor, Justice, Housing and Urban Development and the Judicial Branch on the "A" Network. This constitutes 20% of the total FTS traffic. All other Agencies make up the "B" Network, representing 80% of the traffic.

2.2.2 Results - Iteration II (20-80 split)

Cost of Network "A" under standard pricing - 21.0 cents/min.

Cost of Network "B" under standard pricing - 18.1 cents/min.

Cost of Network "A" under aggressive pricing - 17.3 cents/min.

Cost of Network "B" under aggressive pricing - 14.7 cents/min.

The "A" and "B" Networks have 437 and 1113 Service Delivery Points (SDP's) respectfully while 283 SDP's are dual homed.

2.3 Iteration III - 25/75 Network Split

2.3.1 Agency Partition

The Departments of Treasury, Justice, Housing and Urban Development, Veterans Administration and the Judicial Branch were placed on the "A" Network. All other Agencies made up the "B" Network.

2.3.2 Results - Iteration III (25-75 split)

Cost of Network "A" under standard pricing - 20.6 cents/min.

Cost of Network "B" under standard pricing - 18.2 cents/min.

Cost of Network "A" under aggressive pricing - 17.0 cents/min.

Cost of Network "B" under aggressive pricing - 14.6 cents/min.

The "A" and "B" Networks have 602 and 949 Service Delivery Points (SDP's) respectfully while 284 SDP's are dual homed.

2.4 Iteration IV - 30/70 Network Split

2.4.1 Agency Partition

The Departments of Treasury, Justice, Labor, Housing and Urban Development, GSA, Veterans Administration and the Judicial Branch were placed on the "A" Network. All other Agencies comprise the "B" Network.

2.4.2 Results - Iteration IV (30-70 split)

Cost of Network "A" under standard pricing - 19.8 cents/min.

Cost of Network "B" under standard pricing - 18.5 cents/min.

Cost of Network "A" under aggressive pricing - 16.2 cents/min.

Cost of Network "B" under aggressive pricing - 14.9 cents/min.

The "A" and "B" Networks have 697 and 856 Service Delivery Points (SDP's) respectfully while 286 SDP's are dual homed.

2.5 Iteration V - 35/65 Network Split

2.5.1 Agency Partition

This configuration places the Departments of Treasury, Justice, Labor, Housing and Urban Development, Veterans Administration and GSA on the "A" Network. All other Agencies make up the "B" Network.

2.5.3 Results - Iteration V (35-65 split)

Cost of Network "A" under standard pricing - 19.6 cents/min.

Cost of Network "B" under standard pricing - 18.6 cents/min.

Cost of Network "A" under aggressive pricing - 16.1 cents/min.

Cost of Network "B" under aggressive pricing - 15.0 cents/min.

The "A" and "B" Networks have 769 and 790 Service Delivery Points (SDP's) respectfully while 292 SDP's are dual homed.

2.6 Iteration VI - 50/50 Network Split

2.6.1 Agency Partition

The "A" Network consists of the Departments of Treasury, Labor, Justice, Interior, Housing and Urban Development, Veterans Administration and GSA. All others comprise the "B" Network.

2.6.3 Results - Iteration VI (50-50 split)

Cost of Network "A" under standard pricing - 18.4 cents/min.

Cost of Network "B" under standard pricing - 19.5 cents/min.

Cost of Network "A" under aggressive pricing - 15.2 cents/min.

Cost of Network "B" under aggressive pricing - 15.5 cents/min.

The "A" and "B" Networks have 915 and 653 Service Delivery Points (SDP's) respectfully while 301 SDP's are dual homed.

SECTION 3

ASSUMPTIONS/CONSTRAINTS

The nationwide coverage offered in these iterations is similar to that on the consolidated baseline network. The same switches and Points of Presence (POPs) that were used in the single network solution were used to design each of the split networks. Not all POPs were utilized in each of the split network designs.

An overhead factor of 12% was employed to adjust source carried traffic to offered traffic, as in the single network solution. Growth factors were utilized to update the traffic to a closer approximation of today's volumes. Standard tariff service was first utilized to assess a cost basis for conservative network pricing. Subsequently compression and bulk discount tariff pricing was used to determine network costs from a more aggressive basis.

SECTION 4

FINDINGS

The results of the work present three perspectives of the economic impact:

- One as viewed from GSA, as the procurer who must consider total cost to the Government as the primary focus. All six iterations are relatively equal in terms of total network cost which is constant within 1.5% for any split. There is no abrupt fall-off in economy of scale below 40%. Refer to the graph annotated "FTS 2000 Network Designs - Unit Cost vs. Split" for a depiction of this finding across the seven design iterations.

- The second from the standpoint of the user Agency, is that the cost for both networks should be nearly equal to avoid penalizing the users on the more expensive network which could lead to considerable shifting of Agencies between networks. For Agencies, the cost differential increases between the two networks as the split diverges from 60%-40% which has a cost differential of only .1 cents per minute between the two networks. Reference to the graph labeled "FTS 2000 Network Designs - Unit Cost by Network Split %" shows this divergence across the several iterations.

- The final perspective indicates that the vendors under strong competition should bid cost per minute prices which do not exceed those results indicated in this study for the same service.

The graphs and charts contained in Appendix A, following further illustrate the cost comparisons of both standard and aggressive pricing for all iterations.

APPENDIX A

FIS 2000 NETWORK DESIGN GRAPHS AND CHARTS

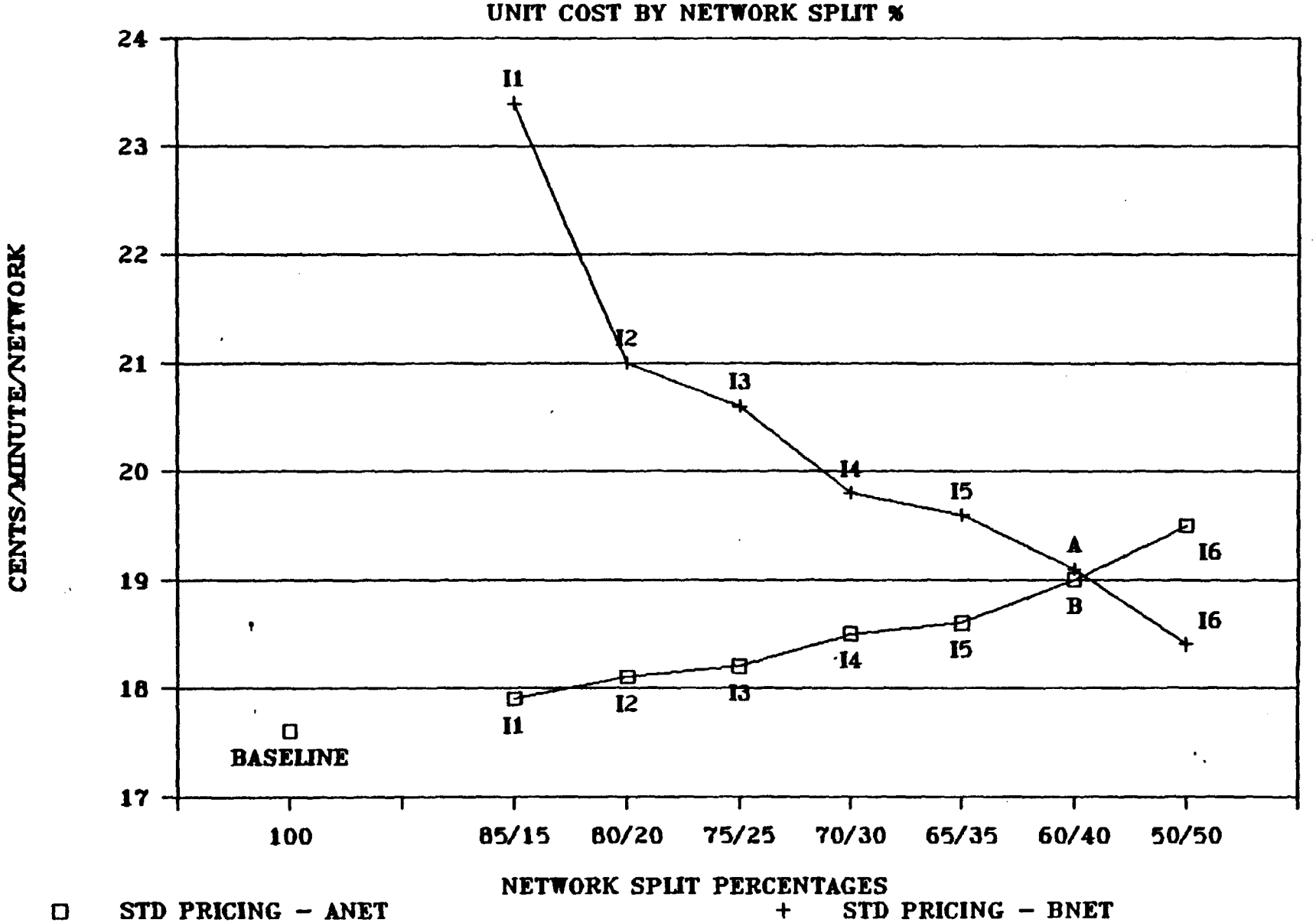
GRAPHS

- Unit Cost by Network Split % - Standard Pricing
- Unit Cost by Network Split % - Aggressive Pricing
- Unit Cost vs. Split - Standard and Aggressive Pricing
- Monthly Cost vs. Split - Standard and Aggressive Pricing
- Unit Cost by Split % - Standard and Aggressive Pricing

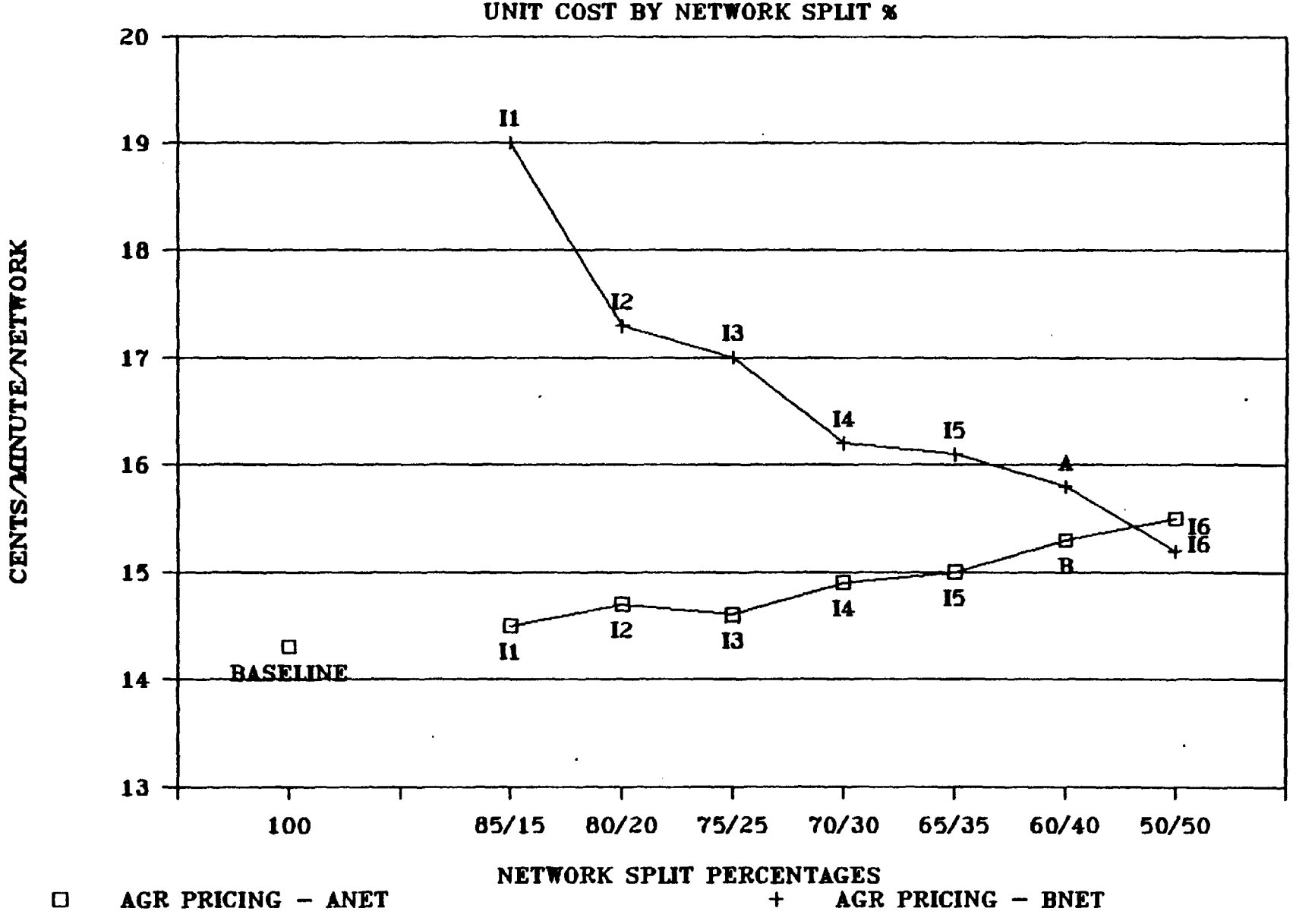
CHARTS

- Network Splits - Design Summary Chart
- Network Split Analysis - Design Summary Chart

FTS 2000 NETWORK DESIGNS



FTS 2000 NETWORK DESIGNS



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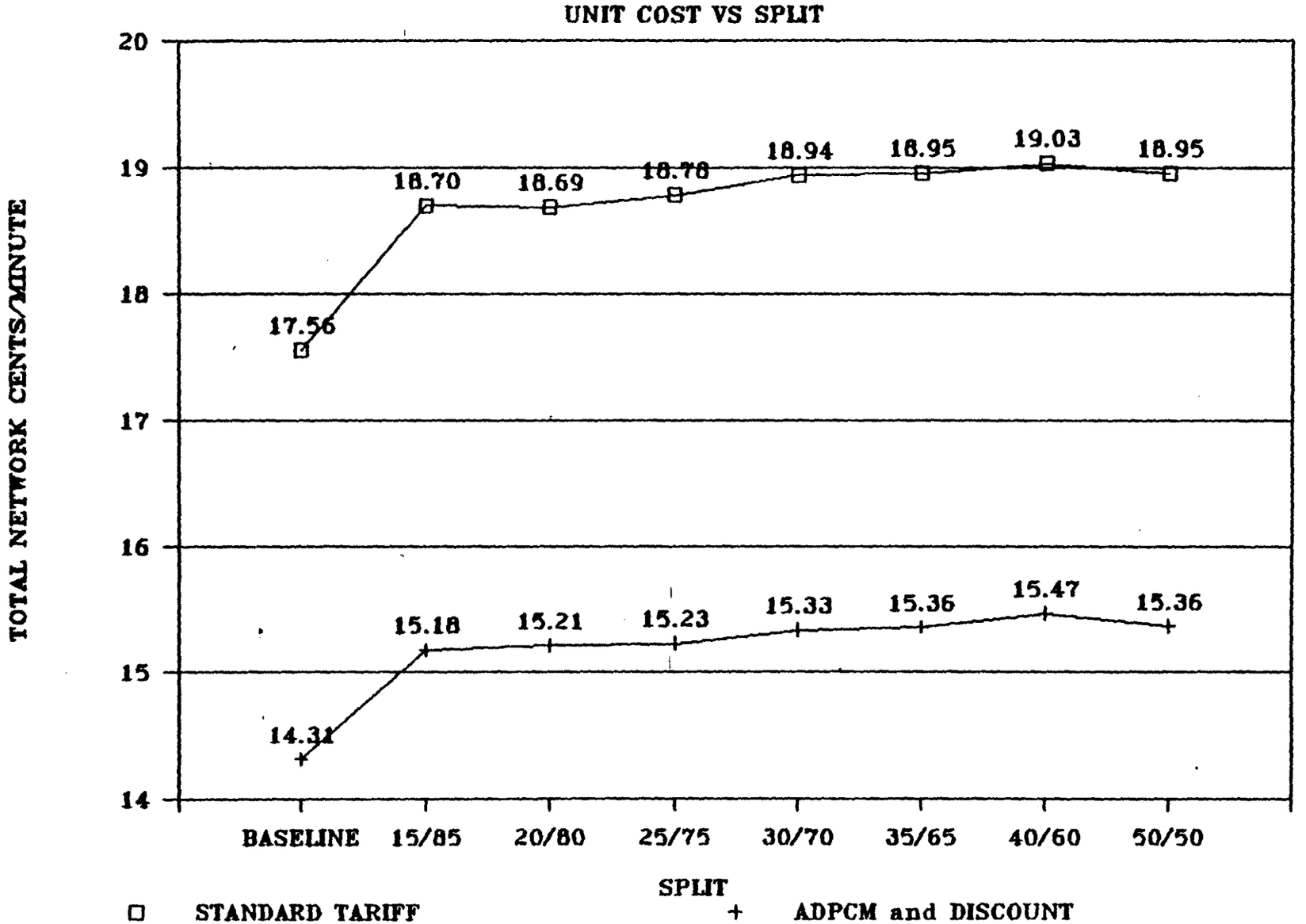

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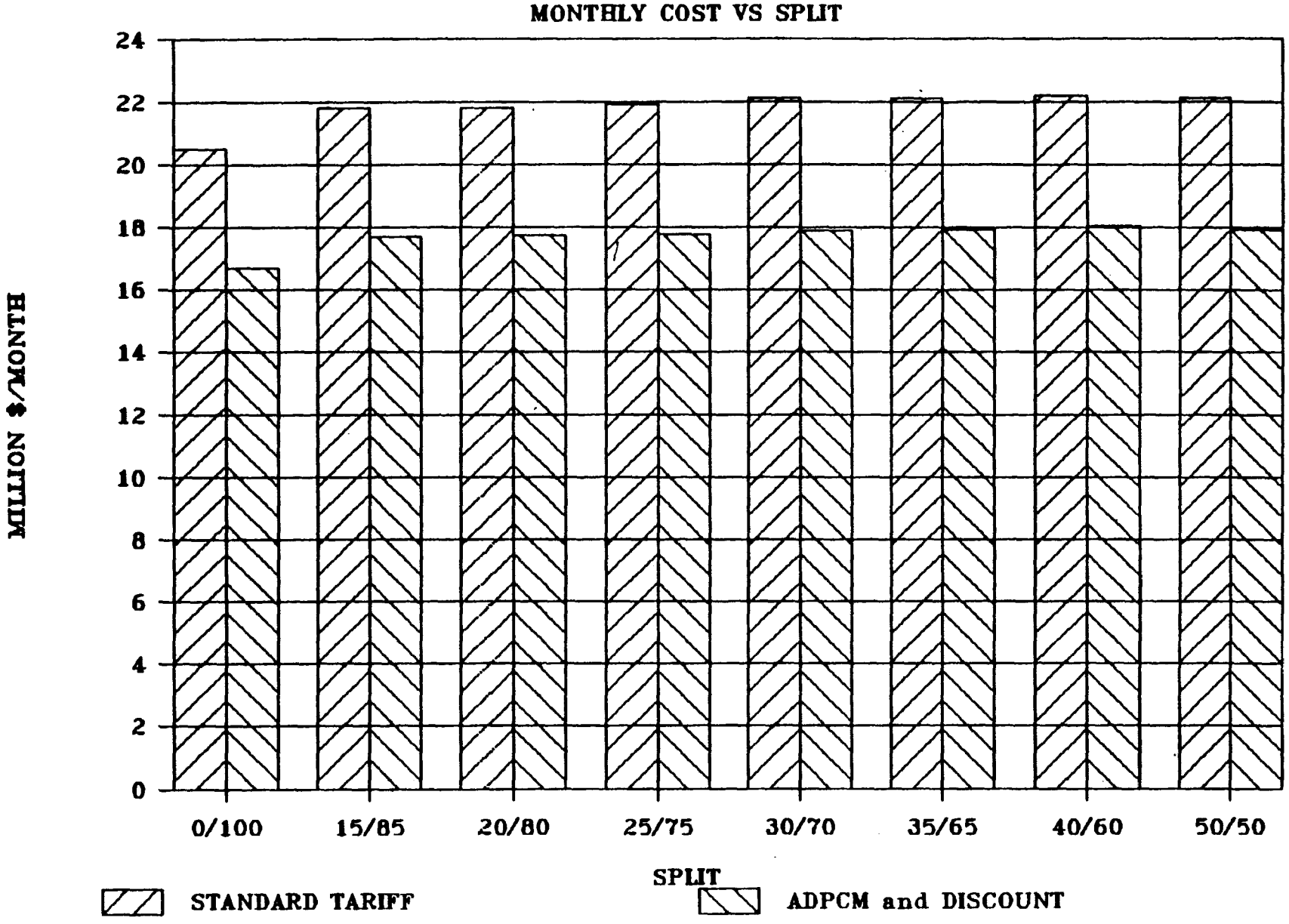

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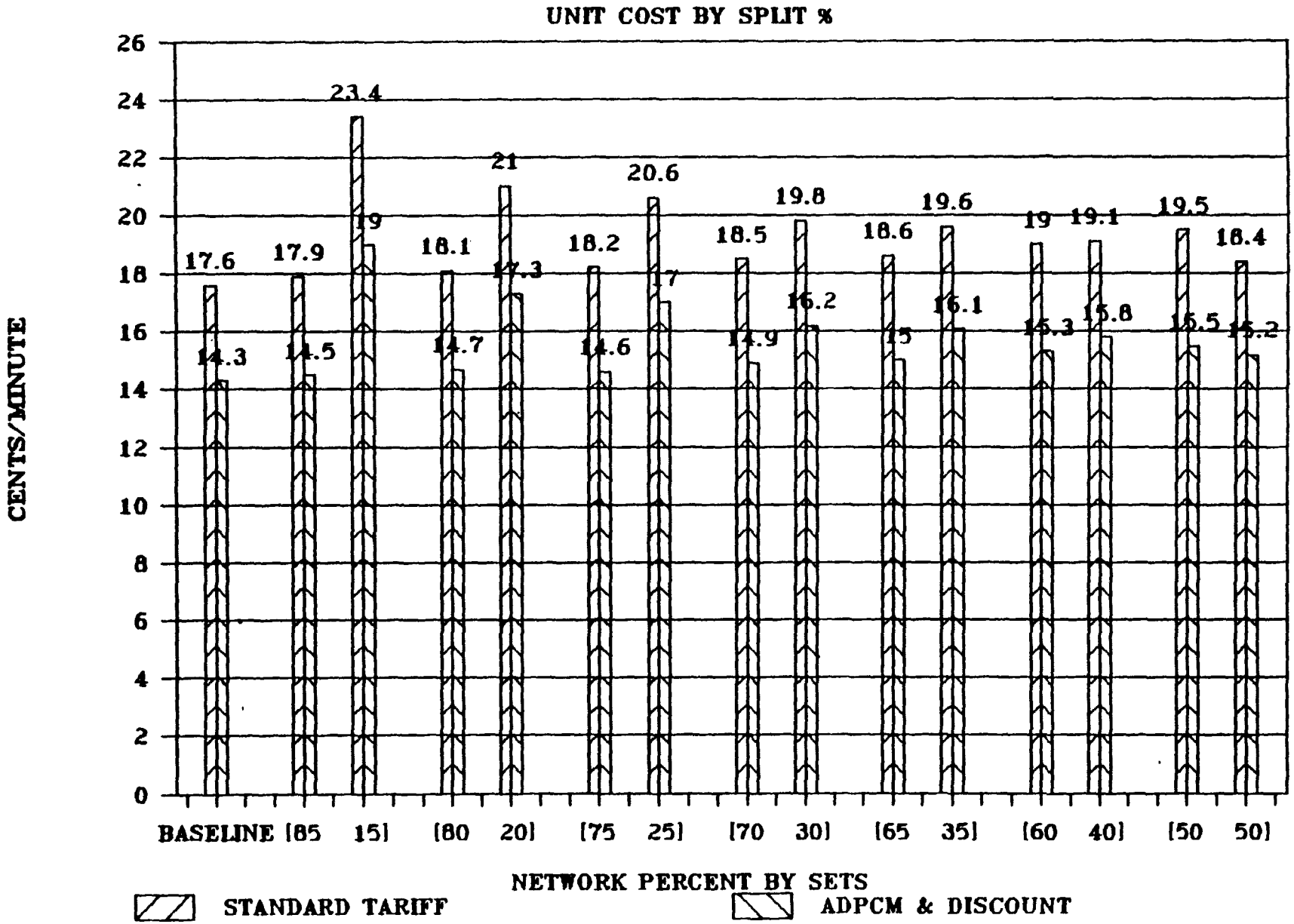

FTS 2000 MILESTONE 4 NETWORK SPLITS

DESIGN SUMMARY CHART

NET	%	CENTS/MIN STD	CENTS/MIN AGR	SERVICE DEL SGL	SERVICE PTS DUAL	TREE	DOT	DOJ	GSA	VAA	DOL	HUD	JUD	HHS	DOI	DOA	COM	DOE	NAS	COE	EPA
1	100	17.6	14.3	1294		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
A	40	19.1	15.8	845	348	X		X	X	X	X	X	X								
B	60	19.0	15.3	797			X							X	X	X	X	X	X	X	X
A	15	23.4	19.0	408	270	X		X													
B	85	17.9	14.5	1129			X		X	X	X	X	X	X	X	X	X	X	X	X	X
A	20	21.0	17.3	437	283	X		X			X	X	X								
B	80	18.1	14.7	1113			X		X	X				X	X	X	X	X	X	X	X
A	25	20.6	17.0	602	284	X		X		X		X	X								
B	75	18.2	14.6	949			X		X		X			X	X	X	X	X	X	X	X
A	30	19.8	16.2	697	286	X		X	X	X	X	X	X								
B	70	18.5	14.9	856			X							X	X	X	X	X	X	X	X
A	35	19.6	16.1	769	292	X		X	X	X	X	X									
B	65	18.6	15.0	790			X						X	X	X	X	X	X	X	X	X
A	50	18.4	15.2	915	301	X		X	X	X	X	X			X						
B	50	19.5	15.5	653			X						X	X		X	X	X	X	X	X

NOTE: ONLY 16 MAJOR AGENCIES INDICATED ABOVE.
SEE ATTACHMENTS FOR COMPLETE DESIGN DETAILS.

DETAILED SUMMARY CHART

FTS 2000 NETWORK SPLIT ANALYSES

ITERATION	NET %	-MONTHLY COST- STD	AGR	MINUTES /MONTH	CENTS/MIN STD / AGR
1	100	20489189	16710091	116689504	17.6/14.3
I-1	15	3997384	3255624	17096666	23.4/19.0
I-1	85	17815648	14448946	99669939	17.9/14.5
I-2	20	4879311	4006534	23190357	21.0/17.3
I-2	80	16926101	13738313	93589450	18.1/14.7
I-3	25	6188327	5106157	30061150	20.6/17.0
I-3	75	15730126	12664660	86533447	18.2/14.6
I-4	30	7327359	6003009	36996528	19.8/16.2
I-4	70	14773724	11892965	79740662	18.5/14.9
I-5	35	7965022	6516311	40576917	19.6/16.1
I-5	65	14148857	11397785	76139607	18.6/15.0
I-A	40	8859290	7339975	46395284	19.1/15.8
I-B	60	13348414	10709524	70178747	19.0/15.3
I-6	50	10790226	8954526	58733608	18.4/15.2
I-6	50	11330155	8983851	58036738	19.5/15.5

STANDARD PRICING

COST SUMMARY REPORTS

FTS 1 (100%) STANDARD COST SUMMARY REPORT

ELEMENT	INVESTMENT	RECURRING	MINUTES	CENTS /MIN
ACCESS	$ 0	$ 4446347	160403086	2.8
OFFNET	$ 0	$ 6253103	72975923	8.6
BKBONE	$ 0	$ 9789738	116689504	8.4
SWITCH	$ 0	$ 0	116689504	0.0
COMPRE	$ 0	$ 0	116689504	0.0
MNGMNT	$ 0	$ 0	116689504	0.0
ACCSDN	$ 0	$ 0	0	0.0
ONSDN	$ 0	$ 0	0	0.0
OFFSDN	$ 0	$ 0	0	0.0
BASIC	$ 0	$ 0	0	0.0
TOTAL	$ 0	$20489189	116689504	17.6

NOTE: Access, Offnet, and Backbone costs include switching

FTSA (40%) STANDARD COST SUMMARY REPORT

ELEMENT	INVESTMENT	RECURRING	MINUTES	CENTS /MIN
ACCESS	$ 0	$ 2021358	63826813	3.2
OFFNET	$ 0	$ 2475779	28963755	8.5
BKBONE	$ 0	$ 4362153	46395284	9.4
SWITCH	$ 0	$ 0	46395284	0.0
COMPRE	$ 0	$ 0	46395284	0.0
MNGMNT	$ 0	$ 0	46395284	0.0
ACCSDN	$ 0	$ 0	0	0.0
ONSDN	$ 0	$ 0	0	0.0
OFFSDN	$ 0	$ 0	0	0.0
BASIC	$ 0	$ 0	0	0.0
TOTAL	$ 0	$ 8859290	46395284	19.1

NOTE: Access, Offnet, and Backbone costs include switching

FTSB (60%) STANDARD COST SUMMARY REPORT

ELEMENT	INVESTMENT	RECURRING	MINUTES	CENTS /MIN
ACCESS	$ 0	$ 2690583	94390617	2.9
OFFNET	$ 0	$ 3902854	45966876	8.5
BKBONE	$ 0	$ 6754977	70178747	9.6
SWITCH	$ 0	$ 0	70178747	0.0
COMPRE	$ 0	$ 0	70178747	0.0
MNGMNT	$ 0	$ 0	70178747	0.0
ACCSDN	$ 0	$ 0	0	0.0
ONSDN	$ 0	$ 0	0	0.0
OFFSDN	$ 0	$ 0	0	0.0
BASIC	$ 0	$ 0	0	0.0
TOTAL	$ 0	$13348414	70178747	19.0

NOTE: Access, Offnet, and Backbone costs include switching